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# Mechanical Requirement and Influence on the Design and Manufacturing of Transverse Stripline Kicker of Taiwan Photon Source (TPS)

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The use of transverse stripline kickers is essential to new 3rd generation synchrotron light sources. They act as one of the major correction mechanism for electron beams to compensate things like the mismatch in four injection kickers. Since how much power is actually needed is difficult to assess beforehand, more unit just needs to be installed when there is not enough power to correct the electron beam. It is essential to make sure the power efficiency to reach electron beam to be as high as possible. Hence the characteristic impedance matching on the power transmission route is critical in both design and manufacturing phase. The goal is to design and manufacture 500 watts transverse stripline kicker with independent x and y directions. The influence of the tolerance on mechanical will be addressed as a form of signal transmission quality. The possible resulted power reflection issue due to mechanical tolerance error will also be discussed. Manufacturing steps and the difficulty on each step will be discussed. The consequence of tolerance mismatch on each step will also be discussed. Time domain reflectometry (TDR) method will be used to verify the design and manufacturing accuracy and identify if there is any issue in these processes.

## Introduction

The use of transverse stripline kickers is essential to new 3rd generation synchrotron light sources. They act as one of the major correction mechanism for electron beams to compensate things like the mismatch in four injection kickers etc. Since how much power is actually needed is difficult to assess beforehand, more unit just needs to be installed when there is not enough power to correct the electron beam. It is essential to make sure the power efficiency to reach electron beam to be as high as possible. Hence the characteristic impedance matching on the power transmission route is critical in both design and manufacturing phase. The goal is to design and manufacture 500 watts transverse stripline kicker with independent x and y directions. Time domain reflectometry (TDR) method is essential to verify the design and manufacturing accuracy and identify if there is any issue in these processes

### 1-Requirement of stripline kicker

The major purpose of stripline kicker is to compensate the deviation of electron trace generated by the mismatch of four injection kickers and the accuracy of vacuum system manufacturing and installation. In theory, they are all perfect. But in reality, they all have engineering limits. This is where the stripline kicker can contribute. Traditionally, stripline kicker was made with feedthroughs and electrodes. There was no special consideration on characteristic impedance matching on the whole structure. Most of the time, the x and y direction were combined in one transverse stripline kicker due to space shortage. The power efficiency of such design is only 2/3 of separate design. The length of kicker electrode is ½ wavelength. Hence, we adopt independent x- and y- direction transverse stripline kicker with 300mm long electrode.

### 2-The importance of characteristic impedance match

It is important to have the whole electrical structure to be impedance matched to have the kicking power to be transferred efficiently. Otherwise the power will be reflected before it reach the electrode and nearby electrons. It is also important to reduce the impedance generated by the kicker structure. Hence we have adopted ground planes in both vertical and horizontal stripline kickers.

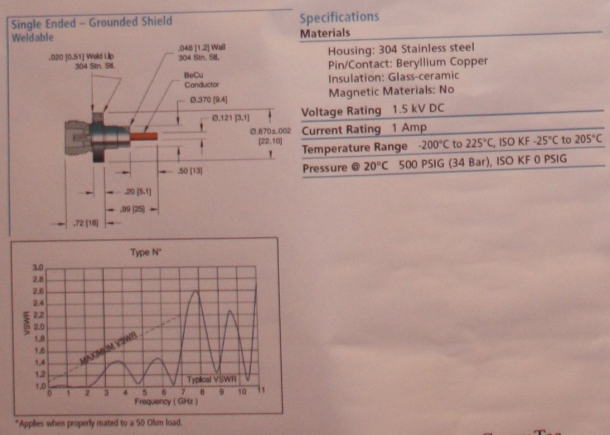


Figure 1. Feedthrough used in TPS stripline kicker (from CeramTec, USA).

### 3-The simulation of vertical stripline kicker

We have just started the simulation of the vertical stripline kicker. The following figures are engineering drawings and drawings for HFSS simulation. This simulation work is ongoing.

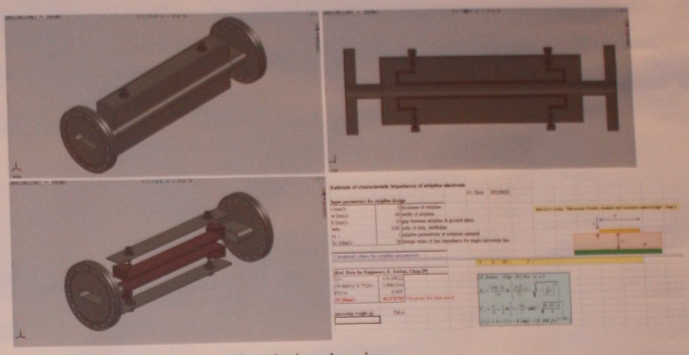

Figure 2. Engineering design drawing.

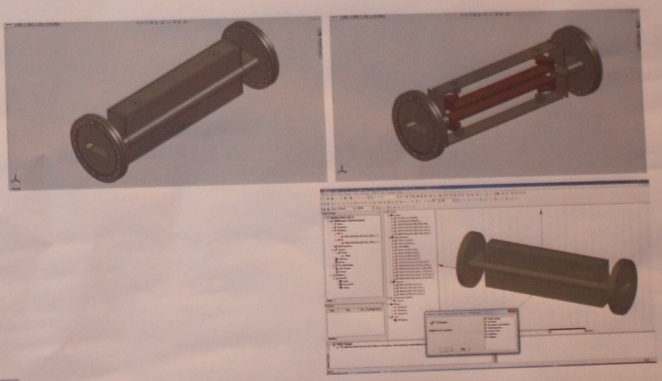

Figure 3. Design drawing for HFSS simulation.

## Reference

1. TPS Design Report, unpublished.
2. T. Nakamura, JASRI/SPring-8 (private communication).
3. HFSS, ver. 14.0.
4. SLS and ALBA stripline kicker design.

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